Meteorological record of voluntary observers and Army post surgeons, September, 1886.

The maximum and minimum temperatures at stations marked thus (*) are from readings of other than standard instruments.

Stations.	Temperature. Maximum.	Minimum.	Mean.	Rainfall.
Alabama.	°	°	°	*Inches.*
Greensborough	89	56	77.7	0.54
Livingston	91	57	78.5	0.68
Mount Vernon B'ks.	97	51	78.8	0.76
Arizona.				
Huachuca, Fort	92	48	68.9	1.46
Lowell, Fort	105	49	81.1	1.04
McDowell, Fort	109	54	84.4	trace
Tucson				2.47
Arkansas.				
Lead Hill	102	47	74.3	8.44
California.				
Alcatraz Island	89	49	56.8	0.02
Angel Island	104	51	62.6	0.00
Benicia Barracks	96	54	66.8	trace
Bidwell, Fort	88	32	62.7	trace
Blue Lake	98	37	59.6	0.00
Cahuenga				0.00
Gaston, Fort	104	30	66.5	0.00
Hydesville				0.00
Mason, Fort	85	53	61.0	0.00
Nicolaus	99	54	72.2	0.00
Oakland	91	50	61.1	0.05
Oroville	96	54	74.2	0.00
Poway	99	58	67.7	0.00
Presidio of San F	94	46	59.4	trace
Princeton	102	41	73.1	0.00
Sacramento	91	44	65.9	0.00
Salinas	88	46	58.5	0.00
Santa Barbara	79	48	63.8	
Colorado.				
Colorado Springs	84	28	59.4	0.33
Lewis, Fort	77	32	55.0	1.62
Connecticut.				
Hartford	86	34	60.4	3.08
North Colebrook	82	32	58.6	1.58
Voluntown	86	36		2.10
Dakota.				
Abr. Lincoln, Fort	95	21	55.5	0.38
Meade, Fort	94	33	58.8	0.40
Pembina, Fort	88	12	51.2	3.90
Randall, Fort	98	23	63.6	4.05
Sisseton, Fort	94	17	56.2	0.78
Sully, Fort	101	30	62.0	0.50
Totten, Fort	85	19	52.7	0.84
Webster	97	16	58.8	1.71
Yates, Fort	95	20	56.6	0.72
District of Columbia.				
Distributing Res'r*	88	50	71.2	2.07
Receiving Res'v'r*	90	52	71.3	2.04
Rock Creek Bridge*	93	52	73.1	
Florida.				
Archer *	92	76	82.2	3.05
Alva*	93	68	76.6	8.90
Meade, Fort				5.40
Limona *	90	71		6.67
Manatee	93	76	81.6	4.22
Merritt's Island	92	70	79.8	6.22
St. Augustine, Fort	88	64	76.8	3.63
Tallahassee				4.65
Georgia.				
Athens	88	57	73.1	0.96
Forsyth*	94	59	78.6	0.10
Milledgeville	91	62	77.3	0.59
Idaho.				
Boisé Barracks	92	29	63.6	0.00
Cœur d'Alene, Fort	83	28	56.2	0.79
Illinois.				
Anna *	92	51	71.2	4.33
Bloomington	89	38		4.35
Collinsville	93	44	69.1	5.12
Charleston*	96	43	68.1	4.02
Geneseo *	93	35	66.6	2.99
Mattoon *	96	42	70.6	4.73
Pekin *	94	37	69.1	7.05
Peoria	94	44	69.8	4.68
Riley	85	34	60.9	2.25
Rockford	86	37	62.2	2.25
Sandwich	90	39	65.9	5.13
South Evanston	89	33		3.79
Sycamore	87	32	61 8	3.23
Windsor	92	39	68.6	3.82
Indian Territory.				
Gibson, Fort	101	40	75.9	3.75
Reno, Fort	100	42	75.4	1.24
Supply, Fort	94	34	71.7	0.20
Indiana.				
Butlerville *	89	40	61.0	1.71
Fort Wayne*	90	45	65.3	9.25
Jeffersonville	89	45	75.2	1 41
Lafayette	91	39	65.8	4.39
Logansport*	90	44	68.4	5.90
Mauzy	85	34	61.5	2.63
Monticello	90	43		3.38
Spiceland	87	40	65.3	2.47
Sunman*	86	38	66.7	1.52
Terre Haute*	87	45		5.90
Vevay	91	46	69.3	1.47

Stations.	Temperature. Maximum.	Minimum.	Mean.	Rainfall.
Iowa.	°	°	°	*Inches*
Bancroft	90	32	60.6	5.03
Cedar Rapids *	90	30	64.1	2.86
Clinton	95	32	63.9	3.89
Des Moines	95	37	65.9	
Fort Madison	91	37		3.45
Independence *	84	39	62.0	4.98
Logan	92	35	70.2	
Manchester*	92	37	63.5	6.76
Monticello *	93	35	63.0	2.80
Mount Vernon	92	39	66.0	
Muscatine	95	34	66.4	3.05
Oskaloosa *a*	90	40	68.0	5.29
Oskaloosa *b**	91	42		
Urbano	97	39	67.3	4.41
Kansas.				
Allison	104	30	67.3	1.18
Atchison *	98	42	71.1	3.07
Belleville	93	58	73.6	4.10
Elk Falls				5.45
Emporia	91	41		0.90
Globe	98	43		
Huys, Fort	92	28	66.8	3.06
Independence *	94	42	71.4	5.27
Lawrence	97	42	71.2	2.34
Manhattan *a*	98	37	70.7	1.18
Manhattan *b*	101	40	78.4	1.14
Riley, Fort	99	39	72.4	0.32
Salina	84	51	73.4	1.03
Sterling	92	39	67.5	0.90
Topeka	101	44	72.8	1.82
West Leavenworth	99	43		2.90
Westmoreland*	99	37	71.0	2.75
Wyandotte	96	41	70.4	2.50
Wellington	95	38	71.3	2.76
Yates Centre	93	40	69.8	3.85
Kentucky.				
Bowling Green	91	45		1.75
Frankfort	94	42	69.2	2.90
Richmond	86	44	68.4	2.07
Louisiana.				
Grand Coteau	90	55	78.3	5.91
Liberty Hill	88	60	81.8	5.42
Luling *	90	58	76.8	3.83
Maine.				
Bar Harbor	82	37		2.58
Cornish *	86	35	56.8	4.95
Gardiner	80	35	57.9	3.68
Kent's Hill	84	32	56.2	3.59
Orono *	88	31	56.2	4.11
Maryland.				
Cumberland	88	44	65.4	1.38
Fallston*	90	40	67.1	1.63
Great Falls*	92	44	68.9	1.04
McDonogh	86	47	67.9	3.20
McHenry, Fort	85	54	69.2	1.22
Woodstock	88	43	66.0	1.61
Massachusetts.				
Amherst *a*	84	32	59.5	5.48
Amherst *b*	85	38	60.6	5.48
Blue Hill Obs'y	82	38	60.2	3.08
Deerfield	86	34	59.8	5.08
Dudley	83	50	63.3	2.20
Fall River	80	40	63.3	2.23
Milton	82	36	58.7	2.89
New Bedford	79	38	62.9	2.17
Princeton	81	35		3.93
Somerset *	89	38	66.4	2.00
Taunton	87	35	62.8	2.62
Westborough	87	32	63.0	2.76
Williamstown	83	35	59.9	4.31
Worcester	77	40	58.7	3.53
Michigan.				
Brady, Fort	89	30	56.6	3.26
Harrisville*	84	32		3.09
Hudson	88	32		6.21
Kalamazoo	82	42	62.0	5.03
Lansing	86	36	61.8	6.05
Mottville	90	42	71.4	7.88
Pentwater	89	33	60.4	6.65
Thornville	90	39	63.1	4.69
Traverse City	91	35		7.61
Minnesota.				
Buffalo	86	32		
Minneapolis	87	32	57.7	5.44
Snelling, Fort	88	23	59.6	3.16
Missouri.				
Carthage	92	44	72.8	
Centreville	94	39		4.73
Central College*	97	43	71.2	0.11
Conception	93	40	67.8	5.05
Pierce City	94	43	71.0	4.30
Montana.				
Assinaboine, Fort	86	36	54.7	0.99
Keogh, Fort	90	28	57.8	0.34
Missoula, Fort	75	29	53.3	1.08
Shaw, Fort	84	29	54.8	1.10

Meteorological record of voluntary observers, etc.—Continued.

Stations.	Temperature. Maximum.	Minimum.	Mean.	Rainfall.
Nebraska.	°	°	°	*Inches*
Brownville	97	43	68.7	6.36
Creto	93	37	64.1	3.21
De Soto *	94	38	64.9	3.53
Fairbury	94			5.15
Fremont *	90	36	63.6	3.39
Genoa	94	38	64.0	3.43
Hay Springs *	92	30	57.8	0.37
Marquette	94	40		3.85
Niobrara, Fort	100	31	61.8	1.28
Robinson, Fort	89	26	56.1	0.30
Stockham	94			1 85
Sidney, Fort	96	24	59.0	0.60
Tecumseh	95	38	70.0	4.06
Nevada.				
Carson City	90	31	59.0	0.30
McDermit, Fort	90	32	60.6	trace
Halleck, Fort	87	19	52.9	0.20
New Hampshire.				
Antrim				3.40
Ashland				4.09
Belmont				2.73
Berlin Mills	86	26		2.71
Bristol				3.95
Lake Village				3.70
Nashua	87	34	69.1	4.13
Wier's Bridge				4.17
Wolfborough				4.63
Woodstock				4.07
New Jersey.				
Beverly *	88	36	67.7	1.29
Clayton *	95	42	67.5	1.40
Dover *	88	36	62.6	1.07
Egg Harbor City	93	44	67.0	1.25
Moorestown	92	46	66.2	1.02
Readington *	92	50	70.7	
Roseland				1.27
South Orange	86	46	62.6	1.00
Upper Montclair	85	43	64.9	1.33
Vineland	86	52	68.2	1.24
New Mexico.				
Bayard, Fort	91	44	66.7	2.93
Gallinas Spring	85	42		7.78
Puerto de Luna	87	45	63.8	3.85
Selden, Fort	98	41	70.4	3.25
Union, Fort	83	30	58.9	3.94
Wingate, Fort	83	34	59.5	1.06
New York.				
Auburn	86	41	61.4	4.29
Columbus, Fort	84	50	67.7	1.81
Cooperstown *	85	37	59.0	4.12
David's Island	88	30	67.9	1.84
Factoryville*	90	40	61.0	3.01
Humphrey *	87	44	60.2	3.91
Ithaca	90	39	61.7	3.93
Le Roy	90	38	60.5	3.34
North Volney *	90	42	61.1	
Palermo*	84	38	54.9	3.70
Palmyra *	90	44		
Penn Yan				2.76
Plattsburg B'ks	87	32	58.9	2.36
Syracuse	91	48		
Setauket	80	45	65.7	1.03
West Point	85	40	66.3	1.70
White Plains	82	40	65.5	1.79
North Carolina.				
Chapel Hill	94	52	75.9	2.86
Lenoir	83	53		2.70
Lincolnton	82	58	69.3	1.18
Raleigh	90	60	76.0	4.20
Reidsville *	99	60	75.0	0.13
Statesville*	88	58	71.1	1.08
Wake Forest	93	52	71.9	4.80
Weldon *	92	56	72.0	1.75
Ohio.				
Cleveland	87	42	64.6	4.26
College Hill*	93	43	69.2	2.00
Elyria	90	39	64.8	3.56
Garrettsville	91	34	60.9	2.19
Hiram	91	43	63.3	2.80
Jacksonborough*	90	40	66.5	4.45
Napoleon	88	41	64.9	5.15
North Lewisburg	91	41	68.2	6.10
Portsmouth	89	46	66.9	3.99
Ruggles*	90	41	61.9	4.40
Tiffin *a*	90	46	65.2	4.00
Tiffin *b* *	90	41	62.5	4.01
West Milton	95	39	65.0	7.50
Wauseon	90	30	63.2	4.47
Westerville	86	38	63.6	4.77
Yellow Springs	82	41	63.6	5.09

Stations.	Temperature. Maximum.	Minimum.	Mean.	Rainfall.
Oregon.	°	°	°	*Inches*
Albany*	98	48	63.8	1.20
Bandon*	71	38	51.2	0.49
East Portland*	90	38		0.04
Eola *	91	47	62.2	1.08
Klamath, Fort	90	19	52.8	0.00
La Grande	89	34		0.40
Mount Angel*	96	43	62.6	19.17
Pennsylvania.				
Altoona	88	40	65.9	2.45
Blooming Grove *	88	42	61.6	3.80
Bethlehem *	90	42	67.8	1.77
Catawissa *	88	42		4.20
Dyberry	87	34	59.9	5.06
Easton				1.33
Fallsington	87	47	68.2	0.85
Franklin*	84	34	55.9	3.20
Germantown*	90	48		0.81
Grampian Hills*	88	38	65.8	4.50
Mahanoy Plane	88	46	68.0	2.23
Philipsburg *	73	32	57.4	4.80
Quakertown	86	41	64.3	1.17
Wellsborough *	88	34	60.1	4.11
West Chester	90	45	66.5	1.10
Wilkesbarre	91	38	63.5	4.77
Wysox	86	42	64.0	4.25
Zionsville	89	56	73.5	1.26
South Carolina.				
Kirkwood *	82	61	72.7	2.19
Pacolet	82	64	73.2	1.54
Spartanburg	84	65	73.2	1.00
Stateburg*	88	60	74.1	2.05
Tennessee.				
Ashwood	90	47	68.5	3.08
Milan	96	46	71.5	4.77
Texas.				
Austin *	96	59	81.0	12.33
Cleburne	92	50	76.0	4.20
Comfort				3.10
Concho, Fort	95	51	75.6	0.76
Corsicana				5.41
Midland	91	45	72.0	1.47
McIntosh, Fort	96	62	80.4	4.40
Ringgold, Fort	103	60	81.4	6.82
New Ulm	94	62	77.8	7.81
Silver Falls	92	42	82.0	5.58
Vermont.				
Brattleborough	88	32	60.6	4.25
Burlington	84	34	58.6	3.73
Charlotte*	88	38	60.5	4.20
Lunenburg	86	37	59.5	3.98
Newport	86	32	56.9	4.66
Post Mills*	86	29	54.5	3.04
Poultney	90	32	57.7	4.09
Strafford	84	32	60.0	4.52
Virginia.				
Accotink	89	45	69.1	1.94
Bird's Nest*	93	59	75.7	1.80
Bruington				4.90
Dale Enterprise*	93	48	72.9	1.58
Marion	85	49	66.0	1.10
Rappahannock St'n	92	46	71.2	2.64
Snowville	84	46		
Summit	95	42	68.9	
University of Va	80	53	66.5	1.75
Variety Mills	89	45	67.5	1.42
Wytheville	83	42	65.3	0.48
Washington Territory.				
Bainbridge Island *	82	42	48.8	1 21
Kenewick	102	29		0.09
Spokane, Fort	94	29	60.3	0.28
Tacoma *	76	40	59.5	2.12
Townsend, Fort	79	40	57.4	0.87
Walla Walla, Fort	92	36	60.2	0.09
West Virginia.				
Clarksburg	85	42	66.2	2.41
Helvetia*	84	38	61.9	4.37
Parkersburg	91	44	66.0	1.94
Wisconsin.				
Delavan	88	32	61.8	2.79
Embarras *	90	38	60.5	5.20
Fond du Lac *	90	28		3.59
Lancaster	92	32	60.8	
Madison	86	37	60.8	2.29
Manitowoc	80	34	57.1	6.68
Prairie du Chien	92	36	62.3	3.45
Wausau	88	30	55.8	3.23
Wyoming.				
Laramie, Fort	88	25	58.9	0.30
McKinney, Fort	88	31	55.8	0.70
Washakie, Fort	90	17	57.5	0.17

NOTES AND EXTRACTS.

The following is an extract from the September, 1886, report of the "Alabama Weather Service," under direction of P. H. Mell, jr., of the Agricultural and Mechanical College, Auburn:

The remarkable feature about the month of September consists in the small

per cent. of rain that fell throughout the state. The season was excessively dry, and vegetation suffered very much for want of moisture. However, the bright, clear days have been favorable for gathering the rapidly-ripening cotton. The state escaped the usual September gales, and with the exception of the heavy precipitation at Tuscumbia on the 14th, 5.16 inches, there were no violent storms reported from any section. The average rainfall was 2.57 inches below the normal.

The temperature was rather high during the middle of the month but toward its close the mercury fell very rapidly, recording a degree of cold that made fires comfortable.

The average temperature of the state was 0°.3 above the normal.

Summary.

Temperature.—Mean temperature, 76°; highest temperature, 95°, at Marion, on the 12th; lowest temperature, 42°, at Gadsden, on the 30th; range of temprrature, 53°; greatest monthly range of temperature, 52°, at Gadsden; least monthly range of temperature, 26°, at Selma; mean daily range, 16°; greatest daily range of temperature, 36°, at Gadsden, on the 30th; least daily range of temperature, 1°, at Eufaula, on the 30th, and Florence, on the 15th.

Rainfall.—Mean depth of rainfall, 1.46 inches; mean daily rainfall, 0.052 inch; greatest depth of monthly rainfall, 6.90 inches, at Tuscumbia; least depth of monthly rainfall, 0.30 inch, at Marion and Selma; greatest daily rainfall average for state, 0.68 inch, on the 14th; greatest daily local rainfall, 5.16 inches, at Tuscumbia, on the 14th.

Average number of days on which rain fell, 5; average number of cloudy days, 6; average number of fair days, 13; average number of clear days, 11.

Warmest days, 11th, 12th, and 17th; coldest day, 30th.

Prevailing directions of wind, east and southeast.

The following meteorological summary for September, 1886, has been forwarded by Hon. J. T. Henderson, Commissioner of Agriculture for Georgia:

Districts.	Temperature.			Average precipitation.
	Highest.	Lowest.	Monthly mean.	
	°	°	°	*Inches.*
Northern Georgia	99.0	51.0	72.4	0.80
Middle Georgia	96.0	48.0	75.1	0.87
Southwestern Georgia	94.0	59.0	79.1	3.57
Eastern Georgia	98.0	64.0	77.7	0.95
Southeastern Georgia	88.0	66.0	77.8	5.40
Means for state	98.0	48.0	76.4	2.32

The following is an extract from the "Weather Review of the Illinois Department of Agriculture," for September, 1886, prepared under direction of Col. Charles F. Mills, Springfield:

Divisions.—The state covers such an extended area from north to south (385 miles) that it has been found advisable to divide the same and follow the judicial divisions, which include the following territory, viz.: the northern division extends from 42° 30′ to about 40° 31′; the central division extends from about 40° 31′ to about 39°; the southern division from about 39° to 36° 51′.

Temperature.—The mean temperature of the state for the month, 67°.8, was 2°.4 above the normal for twelve years. The mean temperature of the northern division was 65°.4; of the central division, 67°.9, and of the southern division, 70°.2.

The greatest departure from the normal was at Peoria, Peoria county, where it was 2°.8 above the normal for thirty years.

The maximum September temperatures are as follows: 1881, 101°; 1882, 95°; 1883, 96°; 1884, 99°.5; 1885, 94°, and 1886, 98°. The minimum temperatures are, in 1881, 42°; 1882, 30°; 1883, 31°; 1884, 41°; 1885, 30°, and 1886, 32°.

The highest temperature reported during the month, 98°, occurred at Pontiac, Livingston county, on the 8th and 9th; at Sumner, Lawrence county, on the 8th, and at Centralia, Marion county, on the 9th. The lowest reported, 32°, occurred at Pontiac on the 29th, making the absolute range for that place 66° for the month.

The hot wave of the 5th to 9th and cool wave of the 29th and 30th extended over the entire state. Several stations in the southern division report the highest temperature on the 23d and 24th, but they are the exceptions.

Precipitation.—The average precipitation for the state was 4.67 inches; for the northern division, 4.03 inches; central division, 5.68 inches, and southern division, 4.30 inches. It was 1.37 inches above the September normal for the state; 0.86 of an inch above the September normal for the northern division; 2.43 inches above for the central division, and 0.94 of an inch above for the southern division.

The greatest departures from the normal precipitation occurred as follows: Greenville, Bond county, 2.18 inches above; Pana, Christian county, 3.94 above; Aurora, Kane county, 2.60 below; Griggsville, Pike county, 2.05 above; Springfield, Sangamon county, 3.60 above; Mascoutah, Saint Clair county, 2.49 above, and Fairfield, Wayne county, 2.15 inches above.

The following meteorological summary and accompanying remarks are from the September, 1886, report of the "Indiana Weather Service," under direction of Prof. H. A. Huston, of Purdue University, Lafayette:

Districts.	Temperature.			Average precipitation.
	Highest.	Lowest.	Monthly means.	
	°	°	°	*Inches.*
Northern counties	96.0	39.0	65.5	7.81
Central counties	91.0	34.0	65.4	3.94
Southern counties	97.0	40.0	68.1	1.80
State	97.0	34.0	66.3	4.52

The mean temperature of the state for September, 1886, was 1°.6 above the mean of September for the past five years; 1°.4 above the mean of sixteen years at Indianapolis; 0°.5 above the mean of thirty-one years at Logansport; 2°.4 below the mean of twenty-one years at Vevay; 2°.6 above the mean of thirty-three years at Spiceland; 1°.8 above the mean of seven years at Mauzy; 2°.6 below the mean of nine years at Blue Lick; the same as the mean of five years at Worthington; 1°.0 above the mean of seven years at Lafayette. The mean temperature at various stations ranges from 2°.4 above the average at Logansport to 3°.7 below the average at Mauzy.

The mean precipitation for the state for September was 1.16 inches above the mean of September for the past five years; 1.83 inches above the mean of sixteen years at Indianapolis; 1.54 inches above the mean of thirty-one years at Logansport; 1.09 inches above the mean of twenty-one years at Vevay; 1.15 inches above the mean of twenty-eight years at Spiceland; .78 inch below the mean of seven years at Mauzy; 1.18 inches above the mean of five years at Blue Lick; 1.03 inches above the mean of five years at Worthington; 1.66 inches above the mean of seven years at Lafayette. The precipitation at various stations ranged from 2.92 inches above the average at Logansport to 2.73 inches below the average at Mauzy.

The following is from an advance sheet of the "Iowa Weather Bulletin," for September, 1886, prepared under direction of Gustavus Hinrichs, M. D., Iowa City:

September, 1886, was warm and fair, southerly winds and calms largely prevailing; the rainfall was showery and generally in excess of normal.

The mean temperature of the air was two degrees above normal. Since 1871, September has been decidedly warmer twice only, namely, in 1884 and 1881; in 1877 it was slightly warmer than this year. Eight times during the twenty years from 1851 to 1870 has September been decidedly warmer than this year. The first and last decades were quite warm, being over four degrees above normal; the middle decade was decidedly cool, being nearly four degrees below normal.

Cloudiness was about normal, with a slight excess of clear days. Southerly winds or calms prevailed at two-thirds of all the observations. The total run of the wind was also less than normal.

Rainfall was much more frequent than normal, and brought about a wonderful change in the pastures throughout the state. In amount the rainfall was less than four inches in the northwest and east; throughout the balance of the state it exceeded four inches. The southwest and southern-central Iowa received over six inches of rainfall. This high rainfall extended northeastward to Waterloo.

The most notable storm was the squall of the 18th, which attained its greatest intensity in wind, rain, hail, and lightning in southeastern Iowa late in the afternoon.

Fine days were quite frequent. The 29th was especially fine and cool.

While very light frosts occurred locally on lowlands during the latter half of the second decade, the frost of the 29th was the first really general frost of the season; it found the corn perfectly mature and most corn fodder saved in shocks.

No northern lights or other notable phenomena were reported. Damage by lightning has been exceptionally great this month.

The following is from the September, 1886, report of the "Minnesota Weather Service," under direction of Prof. Wm. W. Payne, Carleton College, Northfield:

The severe drought and unusually high temperature which characterized August were notably absent in September just past.

The mean temperature for the state, as deduced from the reports of fifteen stations, is 57°.1, which is 1°.6 below that of the corresponding month of September, 1885. At Duluth it was 5°.0 below the mean of sixteen years; Saint Vincent, 1°.7 below the mean of fourteen years; Moorhead, 1°.6 below the mean of five years; Saint Paul, 0°.8 below the mean of sixteen years; and 0°.2 above the mean of fourteen years at La Crosse. Thus showing from stations where records have been kept for a number of years that the mean temperature was generally below the average, with the departure most decided in the northeastern portion of the state. The maximum temperature registered was 93°.0, at Sherburne, on the 4th, while the minimum was 22°.7, at Moorhead, on the 18th, thus making the range for the state 70°.3. The greatest monthly range of temperature at any one place was 67°.4, at Moorhead, while the least monthly range was 47°.8, at Duluth.

Rain fell generally over the entire state, the average being 4.05 inches, while the greatest amount which fell at any one place was 6.07 inches, at Mankato; the least amount was reported from Moorhead, where the fall amounted to 1.31 inches. The greatest daily rainfall was 2.10 inches, which occurred on the 25th, at Morris. At Duluth, for the month, there was an excess of 1.52 inches of rainfall; Saint Vincent, 1.45 inches; Saint Paul, 0.31 of an inch, and a deficiency at La Crosse of 1.73 inches, and Moorhead, 0.64 of an inch. Stations that reported over an inch of rainfall on any one day, with the dates, are: Dodge Centre, 18th, 1.50; Red Wing, 15th, 1.49, and 18th, 1.18; Mankato, 15th, 1.35, and 18th, 1.30; Rochester, 11th, 1.02; Morris, 15th, 1.85, and 25th, 2.10; Saint Paul, 7th, 1.20; Duluth, 6th, 1.06, and 25th, 1.90; Alexandria, 24th, 1.05.

Thunder-storms were of almost daily occurrence throughout the state during the first fifteen days of the month, but were more numerously reported on the 2d, 3d, 5th, 6th, 15th, 24th, and 26th.

Hail was reported from Saint Vincent on the 5th, and Red Wing on the 15th.

Frosts occurred at Albert Lea on the 17th, 28th, 30th; Sherburne, 19th, 30th; Red Wing, 14th, 28th; Mankato, 29th, 30th; Morris, 30th; La Crosse, 14th, 17th, 28th, 29th; Saint Paul, 28th; Saint Vincent (light), 1st, 8th, 12th (killing), 13th, 14th, 18th, 19th; Duluth, 1st 12th, 13th, 14th, 17th; Moorhead (killing), 12th, 17th, 18th, 28th.

The following is from the September, 1886, report of the "Nebraska Weather Service," under direction of Prof. Goodwin D. Swezey, of Doane College, Crete:

Like the month of August there has been no marked peculiarity in the weather of September unless it is the cold wave, the first of the season, that appeared on the night of the 29th in Minnesota, and extended on the 30th to east Dakota, Iowa, Nebraska, Wisconsin, Michigan, Illinois, Missouri, Indiana, and Ohio, with a minimum temperature of 33°.8 in Nebraska. This was predicted as a cool wave, although cold-wave flags were not ordered up; but the temperature fell lower than was expected.

Four storms, of moderate severity, were felt in Nebraska during the month. The first appeared in northern Dakota on the 14th and was joined on the 15th by a storm which formed in northern Kansas. The second appeared in the Indian Territory on the 18th and moved very rapidly eastward, passing out of the Saint Lawrence Valley on the 19th. The third formed in Colorado on the 24th and moved northeastward. The fourth formed in Colorado on the 26th and, passing northeastward, moved out of the Saint Lawrence Valley on the 28th. All of these were attended by more or less rainfall in the state.

Comparison of past Septembers.

The table shows the mean temperature, the noon temperature, and the number of days above 85° for the past nine Septembers in southeastern Nebraska; they are found by averaging the numbers reported at the different stations. It also shows the highest temperatures and the lowest recorded anywhere in the state by standard self-registering thermometers:

September.	Mean temperature.	Noon temperature.	Above 85°.	Highest temperature.	Lowest temperature.
	°	°	*Days.*	°	°
1878	65.5	75.9	5.3	91.0	33.0
1879	61.1	75.1	3.9	91.0	28.0
1880	64.2	73.8	3.7	93.0	34.0
1881	67.3	76.5	10.3	99.0	36.0
1882	67.5	80.8	10.8	94.0	40.8
1883	60.8	70.7	2.0	91.0	37.0
1884	67.9	76.1	6.3	91.8	39.0
1885	64	78.0	5.0	92.0	42.6
1886	65.4	75.5	9.2	93.3	33.8

The following table shows the precipitation, or depth in inches of rain and melted snow or hail, the number of days on which it fell, and the number of cloudy and of clear days. Days are counted cloudy when the sky is four-fifths overcast; clear when less than one-third. The last column shows the number of thunder-storms:

September.	Precipitation.	Days of precipitation.	Cloudy days.	Clear days.	Thunder.
	Inches.				
1878	2.58	4.3	1.9	18.7	2.2
1879	1.86	5.1	1.5	19.0	2.8
1880	3.41	6.9	2.5	16.5	4.3
1881	4.05	6.5	3.8	17.2	5.5
1882	0.92	1.9	1.4	19.3	2.0
1883	3.38	7.1	6.4	14.0	3.5
1884	2.99	5.8	6.3	13.0	4.9
1885	2.34	6.2	6.0	16.4	2.7
1886	3.59	9.9	4.9	12.5	4.7

The following is an extract from the September, 1886, report of the "Missouri Weather Service," under direction of Prof. Francis E. Nipher, Washington University, Saint Louis:

The mean temperature for September has been 71°.3, which is 2°.3 above the normal. The extremes of temperature were 52° on the 29th and 91°.5 on the 9th. The extreme minimum of September has in former years fallen to or below that of the past month over thirty times, in fact upon every day of the month, and ten times since 1836 the observations of Engelmann show a September temperature of over 95°, the highest being 102°, on September 3, 1864. The temperature has therefore been about normal, and quite uniform in character.

At Saint Louis the rainfall, 9.57 inches, has been in excess of the normal value by 6.6 inches, the normal value being 3 inches. The rainfall in the state has been greatest at Saint Louis, diminishing to about 3 inches in the north, west, and south part of the state. The heaviest rain, over 7 inches, occurred in two areas, the one being east of a line running from the mouth of the Missouri River southwestwardly to Potosi and thence eastwardly into Illinois. The other maximum area lies in a belt stretching from Macon eastwardly into Illinois, where these two areas probably unite.

The mean temperature in the state has been lowest at Ironton, being 64°.3, the highest being at the Signal Office, Saint Louis, 72°.1; Mascoutah, 72°. The lowest minimum, 38°, was reported from Ironton and Mound City. The highest maximum was Miami, 103°; Mound City, 99°.5; Mexico, 99°; Sedalia, 98°; Savannah, Houstonia, and Signal Office at Leavenworth, 97°.

The experience of the past summer should give the farmers of the Northwest great confidence in the soil which they possess. Notwithstanding the severe drouth, the feeding value of the corn crop is probably fully up to the average, while the hay and oat crop, of about normal quantity, was unusually good in quality.

The following summary for September, 1886, is from the "Bulletin of the New England Meteorological Society," published under direction of Prof. Winslow Upton, Providence, Rhode Island:

Summary for September, 1886.

Reports for the month were received from one hundred and forty-one observers.

The first third of the month was fair and dry; the remainder brought frequent rains accompanying the several cyclonic storms of the month, and the last week was generally cloudy and rainy. All the storm-centres passed north of us over Canada, no tropical cyclone approaching near enough to affect our weather. The varying conditions as to temperature and rainfall in the different parts of the month balanced one another, and the average was close to the normal.

First period; fair.—High pressure with fair weather characterized the first ten days of the month. At a few of the eastern stations the first day gave a little rain that should be referred to the last cyclonic area of August; then came five or six days of cool weather with northwesterly winds in front of the centre of high pressure, followed by four or five days of warmer weather with southerly winds as the pressure fell.

Second period; variable.—Light rain occurred at some northern stations, with a faint northern barometric depression on the 9th; more general rains fell on the nights of the 10–11th and 12–13th, while two distinct cyclonic areas moved over Canada, with a day of fair weather and higher pressure between. Another anti-cyclonic area passed us on the 15th, followed by a cyclonic area, traversing Canada on the 16th and 17th, giving us rain with thunder-storms and squalls on the afternoon of the 16th. On the 18th the pressure was again high, but fell as the fourth cyclonic storm approached and passed on the night of the 19th, with rain and thunder.

Third period; fair.—Three days, from the 20th to the 23d, had high pressure, with brisk, cool, northwest wind and fair weather.

Fourth period; rainy.—Rain fell on the 23d between the passage of two anti-cyclonic areas; rain was again frequent from the 25th to the 28th or 29th, while an area of low pressure lingered over the Lakes and Canada. The last two days of the month were generally fair.

Thunder was noted in one part or another of New England in connection with nearly every rain of the month. Light thunder showers occurred in New Hampshire and Vermont on the 9th, 10th, or 11th, and in Connecticut and Long Island on the 12th. A storm of some violence, with strong wind, heavy rain, and destructive lightning, appeared in western Massachusetts about 3 p. m., and reached the coast after 9 p. m.; it was followed by a second one in the western and central parts of the state two or three hours later. One of these storms, probably the earlier, was felt from northwestern Connecticut into southern Maine, and its lightning was visible on Long Island. A thunder-storm on the evening of 19th extended from Connecticut to Maine. A smaller one appeared on the southern coast on the morning of the 23d, and a widespread thunder-storm accompanied the rain of the 28th and 29th, extending from the upper Connecticut River to western Massachusetts about midnight of these dates, avoiding eastern Massachusetts, and moving obliquely into Maine in the early hours of the 29th.

A tornado occurred four miles east of Hartford, Connecticut, on the evening of the 12th.

The following is from the September, 1886, report of the "Ohio Meteorological Bureau," under direction of Prof. B. F. Thomas, of the Ohio State University, Columbus:

The mean temperature, 65°.5, was slightly above the average, which is 64°.8. The September normal (or average for many years) is 65°.38. The range of temperature for the month was only 61°, the range for the preceding three years varying from 67° to 72°.2. The mean daily temperature range was likewise low, being 22°.2, the average being 22°.9.

The rainfall was the heaviest in four years. The normal fall for September is 2.72 inches, but the mean for the month just closed was 4.02. The greatest rainfall recorded was 10.25 inches, at Sidney; the least, 1.3 inches, at Cincinnati.

Summary.

Mean tempetature, 65°.5; highest temperature, 94°.0, on the 9th, at Logan; lowest temperature, 33°.0, on the 21st, at Paulding; range of temperature, 61°.0; mean daily range of temperature, 22°.2. greatest daily range of temperature, 44°.0, on the 3d, at Paulding; least daily range of temperature, 2°.0, on the 12th, at Clarksville.

Average number of clear days, 12.7; average number of fair days, 12.4; average number of cloudy days, 4.9; average number of days on which rain fell, 10.1.

Mean rainfall, 4.02 inches; average daily rainfall, .134 inch; greatest number of days on which rain fell, 16, at Toledo and Wauseon; least number of days on which rain fell, 5, at Oberlin and Weymouth; greatest rainfall, 10.25 inches, at Sidney; least rainfall, 1.30 inches, at Cincinnati.

Prevailing direction of wind, southwest.

The following is an extract from the "Tennessee State Board of Health Bulletin," for September, 1886, prepared under the direction of J. D. Plunkett, M. D., President of the State Board of Health. The weather report is prepared by H. C. Bate, in charge of the State Meteorological Service:

The general meteorological conditions during the month of September showed but little departure from the means of the three previous years. The temperature was, perhaps, slightly above the normal.

The mean temperature was 70°.4, about one degree above the mean for September, 1885, and nearly three degrees below that for the corresponding period in 1884. The highest temperature was 96°, recorded on the 10th, and was three degrees above the maximum of September of last year, and one degree below the maximum of September, 1884. The warm wave, which began about the 7th, was followed close by a cool one and a fall of several degrees about the 12–14th, and this, in turn, was succeeded by another warm wave, which culminated about the 17–18th, and which continued with very slight variations until the last few days of the month, when a marked depression was noted, and, on the 30th, the lowest temperature of the month, 38°, was recorded. This was four degrees above the minimum recorded in September of last year, and three degrees below that in September of the year previous. The proportion of cloudiness during the month was below the normal.

The mean precipitation was 3.11 inches, a little more than half an inch less than the mean for September of last year, and about an inch more than the mean of September of the year previous. It was slightly below the normal in the eastern portion of the state, and above the normal in the western portion. Of the amount the eastern division received an average of less than two inches, the middle division an average of about three and one-fourth inches, and the western division an average of about four and three-fourth inches. The greatest rainfall was 6.19 inches, reported at Memphis. This was the greatest September rainfall reported at that station since its establishment in 1871. The least rainfall reported for the month was 1.07 inches, at Chattanooga, and was the least reported at that station for September since the stablishment of the station in 1879. Even this is considerably over the minimum September precipitation of any three preceding years. The greatest local daily rainfall occurred at Savannah on the 15th, and measured 2.10 inches. A daily fall of two inches was reported on the same day at Fostoria, also a like amount on the day previous at Howell.

The rains of the 12th, 14th, 15th, 27th, and 28th were general, the others were mostly very light and local. The rain of the 14th was the heaviest during the month, an average of more than one inch falling throughout the state on that day. This was followed by a heavy fall the next day. There was comparatively little electrical disturbance during the month, and no very high winds. There were ten days reported without rain. The prevailing winds were southeasterly.

State summary.

Mean temperature, 70°.4; highest temperature, 96°, on the 10th, at Milan; lowest temperature, 38°, on the 30th, at Farmingdale; range of temperature, 58°; mean monthly range of temperature, 42°.4; greatest monthly range of temperature, 51°, at Farmingdale; least monthly range of temperature, 32°, at Careyville; mean daily range of temperature, 17°.3; greatest daily range of temperature, 34°, on the 22d, at Milan; least daily range of temperature, 2°, on the 15th, at Hurricane Switch; mean of maximum temperatures, 88.8°; mean of minimum temperatures, 46°.4.

Average number of clear days, 16.2; average number of fair days, 7.4; average number of cloudy days, 6.4; average number of days on which rain fell, 6.2.

Mean depth of rainfall, 3.11 inches; mean daily rainfall, 0.103 inch; greatest rainfall, 6.19 inches, at Memphis; least rainfall, 1.07 inches, at Chattanooga; greatest local daily rainfall, 2.10 inches, on the 15th, at Savannah; days of greatest rainfall, 12th, 14th, 15th, 28th; day of greatest rainfall, 14th; days without rainfall, 1st, 2d, 3d, 4th, 5th, 9th, 21st, 22d, 24th, 30th.

Warmest day, 10th; coldest day, 30th.

Prevailing winds, south and southeast.

The study of the motions of the upper currents of the atmosphere is of so great importance that it has been deemed wise to present the following abstract of a paper by Prof. J. Kiessling, of Hamburg, Germany, published in the "Sitzungsber. der Kgl. Preuss. Akad. d. Wiss. zu Berlin," 1886, page 529:

THE MOTION OF KRAKATOA SMOKE IN SEPTEMBER, 1883.

[Translation from the German by Junior Prof. H. A. HAZEN.]

Mr. W. Siemens, in his investigation upon the conservation of energy in the earth's atmosphere, considers that this is dependent upon the rotation-velocity, and he draws the conclusion that by the general air circulation between 35° north and south latitude, as well in the upper poleward directed air current as in the lower along the equator, there is a lagging behind the earth's rotation, hence it must be directed to the west, and that by wholly lacking friction this velocity on the equator must amount to 84 metres per second (188 miles per hour), from east to west. The optical appearances following upon the outburst of Krakatoa places the theoretical considerations in the hand of experience for proof, since the paths of the smoke masses thrown into very high atmospheric layers immediately after the outburst could be clearly followed more than a week.

I present the following from the results obtained from a discussion of the geographical relations established by observations:

The outburst occurred at the time of the year when the sun's heat is greatest along the northerly tropic. If the view of Mr. Siemens be correct, at this time of year, not only the middle line of the equatorial air ring, but also the turning point on the south side of this ring of the spirally rising trade-current, must lie in the neighborhood of the north tropic. Since in the first outburst of Krakatoa, on May 20, 1883, the smoke column reached a measured height of 11,000 metres (7 miles), we may consider that in the incomparably heavier explosion of August 27th smoke and dust masses penetrated through the lower trade current into the upper trades. Both streams then on August 27th must have carried smoke clouds in a circular path about the earth.

The observations appear to establish the correctness of this conclusion. From a study of ships' journals I have been able to place upon a chart the course of each ship whose captain had made note of special appearances during this period. Thereby it is possible to obtain at a full glance just the conditions of the equatorial zone in which the volcanic smoke clouds were clearly seen. The supposition is probable that those captains who have made any note of the appearances have written complete journals, so that we must conclude that the lack of a note is due to the absence of any strange optical appearance.

This chart gives the following:

(1.) By far the greater portion of the general smoke mass had a west-by-north motion at the equator.

(2.) These smoke masses did not form a single cloud, as considered by Mr. Ringwood, Sereno Bishop, and Verbeck, but perhaps a succession of clouds of different magnitude, of which those in a meridional direction were so small that they could be sailed through in a few days from north to south. From the difference of time of the appearances at various places it is possible to calculate a mean velocity of the general motion. The exact moment of time at which the motion of the smoke masses began cannot be told, as already on August 26th west of Krakatoa there were appearances clearly due to smoke clouds, while the principal eruption was on August 27th. In spite of this uncertainty it is possible to calculate the mean velocity of the smoke masses which passed across the equator in a north direction, as also of those which moved along the equator, this was the same for both, and amounted to 36 to 40 metres per second (81 to 89 miles per hour).

(3.) Small parts of the principal mass along the equator toward the north and south lag behind in their motion.

(4.) When a ship with a west course reaches a cloud so is there first a blue or green color of the sun and still later an extraordinary increase in the twilight colors. Now we have experimental proof that the so-called sun colors, through a fine and thick smoke, were wholly independent of the chemical composition of the ingredients, while the intense diffraction colors were formed only through homogeneous, *i. e.*, uniform particles forming a cloud. The succession of the appearances is therefore an indirect proof of the correctness of the view that they were formed by smoke clouds which had a motion from east to west in the lower part of the atmosphere.

(5.) It is possible to follow the smoke clouds in a south-southwest direction; these show an original velocity of 30 to 40 metres per second (67 to 89 miles per hour) in a west direction; moreover, already in the middle of September they have advanced to 40° south latitude, and have asserted their optical properties in Australia, Africa, and America.

(6.) Near both these it is possible easily to follow, in a north-northeast direction, smoke clouds along the Chinese coast to Japan. They were observed at the light-houses "Fisher Island," "Middle Dog," "Chefoo," and on August 30th in Tokio; this shows a velocity of 20 metres per second (45 miles per hour).

(7.) Toward the northeast from Krakatoa strange appearances are not observed immediately after the eruption. Hence, fourteen days later, sun colors are noted at Borneo, due to smoke masses coming up after a complete circuit of the earth from the east. On the other hand, in an easterly direction at Boeleleng in Bali, two to three days after the outburst, a considerable darkening, and at New Ireland an unusual color of the heavens, were observed. This would seem to show an undoubted easterly air current.

It is possible to show, from competent side deliberations, how from the winter of 1883–'84 to the autumn of 1885, in the region of the temperate zone, there were observed optical appearances in causal connection with the Krakatoa outburst. What quantity of particles thrown into the atmosphere

would be needed in order that, by their propagation above so great a part of the world, they might make the marked appearances? Further, what sufficient influence can there be over the weight of the particles so that dust could be held two years floating in the atmosphere?

Both objections are of no weight as shown by experimental proof. It is easy to show that air which is full of extremely fine dust, or artificially ground Krakatoa dust, has very little influence in the development of homogeneous clouds, that is, clouds consisting of uniform water-drops, in comparison with the powerful cloud-forming action which comes from such gases of combustion as are beyond observation by direct optical means. Hence a computation of the quantity of solid ingredients of the Krakatoa outburst is of no importance in determining the causes which lie at the base of the above optical appearances.

This is confirmed also by the observed appearances through the summer of 1831, immediately after the submarine eruption of the island of Ferdinandea, the development of abundant sulphur-bearing products was then so great that the German savant, Professor Hoffmann, Drs. Philippi and Schultz, at the end of July, found in Sciakka different silver vessels which were plainly attacked by the volcanic gases. The height of the appearance as measured by Professor Hoffmann and Dr. Schultz, at points fourteen nautical miles apart, was plainly 20 k. m. (12.4 miles). It is worthy of note that the gas thrown into the air in the south of Sicily, asserted its optical effects from August 2–4th, nearly simultaneously in Madrid, Genoa, Rome, Berlin, Odessa, Irkutsk, and Werchneudinsk. The many letters collected by me show that the same optical effect was observed in very high-lying cloud layers.

The question of the suspension of smoke masses and the resulting condensation products in high atmospheric layers, finds an easy experimental solution. From a long series of investigations with extremely fine smoke, whose ingredients did not appear to permit microscopic measures, a falling velocity of .003 m. per minute, at the ordinary air pressure, has been determined. At a height of 20 k. m. (12.4 miles), this velocity would amount (according to Ferrel's formula) to about .01 m. per minute, therefore in one year it would fall, if the air were perfectly quiet, 5,300 m. (17,389 feet) at the most.